

REMARKS

Claims 1 to 5 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Morita (U.S. Patent No. 5,310,843) in view of Kitano et al. (U.S. Patent No. 6,544,670), Tang et al. (U.S. Patent No. 4,769,292), and Mimura et al. (Photoelectric Properties of Organic Polysilane Containing Carbazolyl Side Groups, Applied Physics Letters, 2 October 2000, 77, No. 14, 2198-2200) for the reasons of record.

Applicant respectfully submits the Office has failed to establish a sufficient factual inquiry of obviousness as stated in *Graham v. John Deere Co.*, and further described in the Examination Guidelines for Determining Obviousness Under 35 U.S.C. 103 in view of the Supreme Court Decision in *KSR v. Teleflex Inc.*, (Federal Register/Vol. 72, No. 195, pages 57526-57535).

In particular, Applicant respectfully submits the Office failed to determine the scope and content of the prior art, and subsequently failed to ascertain the differences between the prior art and the claims at issue. Absent such inquiry, the Office has apparently used the Applicant's teaching to search through the prior art for the claimed elements and then attempted to combine them as claimed.

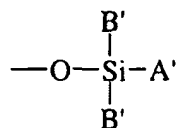
The present invention relates to carbazolyl-functional polysiloxane resins and more particularly to carbazolyl-functional polysiloxane resins containing N-carbazolylalkyl groups. The present invention also relates to a silicone composition containing a carbazolyl-functional polysiloxane resin, and an organic light-emitting diode (OLED) containing a carbazolyl-functional polysiloxane. Importantly, the OLED of the present invention exhibits good resistance to abrasion, organic solvents, moisture, and oxygen. Furthermore, the OLED exhibits high quantum efficiency and photostability.

Morita discloses an MQ organopolysiloxane resin compatible with organic plastics, having an epoxy-containing organic group. Morita discloses that because the organopolysiloxane carries epoxy-containing organic groups, it is useful as a physical property modifier or plasticizer for thermosetting resin compositions (col. 6, lines 6-12). Morita does not teach a polysiloxane resin

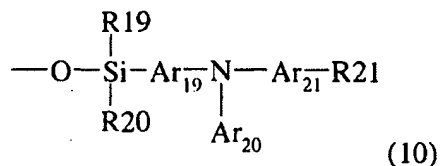
containing siloxane units having a carbazolyl group or any other nitrogen-containing group attached to silicon through an alkylene group having 3 to 10 carbon atoms.

Moreover, Morita does not teach or suggest a silicone composition comprising a functional polysiloxane resin, a condensation catalyst, and an organic solvent. Instead, Morita teaches a method of making an organopolysiloxane having an epoxy-containing group comprising reacting in the presence of (A) a hydrosilylation-reaction catalyst, with (B) an SiH-containing organopolysiloxane, (C) an aliphatically unsaturated epoxy-containing organic compound, and optionally (D) an alkoxyalkene (col. 2, lines 33-51). Morita also teaches the reaction mixture may include an organic solvent (col. 5, lines 63-65).

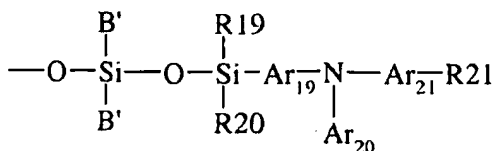
Kitano et al. teach a hole transporting polymer including a repeating unit represented by one of formulas (1) and (5) (see Abstract). Kitano et al. also teach the second hole transporting polymer or the third hole transporting polymer may include structural units represented following formula (s1) and (s2) (col. 16, line 39-col. 17, line 36). The last structure in col. 17, line 25 has the formula:



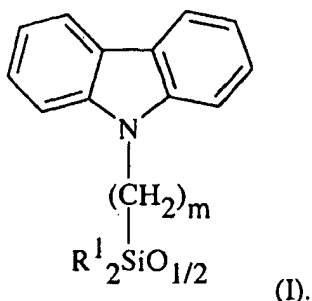
where A' represents an aromatic amine group in the repeating structural unit represented by the general formula (10):



Substituting the repeating structural unit having the formula (10) for A' in the first formula gives a unit having the formula:



which is markedly different from unit (I) of the instant invention, which has the formula:



The unit taught by Kitano et al. neither contains a carbazolyl group nor a divalent alkylene group having 3 to 10 carbon atoms linking the nitrogen atom to the silicon atom of the siloxane unit.

Tang et al. teach that aromatic tertiary amines and N-substituted carbazole compounds are useful as hole-transporting compounds in the electroluminescent device of their invention. However, Tang et al. do not teach or suggest that *substituent groups* derived from N-substituted carbazole compounds are equivalent and interchangeable with the tertiary amine *substituent groups* in the siloxane polymer of Kitano et al. for the purpose of hole transport. The hole transport properties of a carbazolyl-substituted siloxane are not due merely to the carbazolyl substituent independent of its macromolecular environment. Rather, the hole transport properties of a carbazolyl-substituted siloxane are influenced by many factors, including polymer structure, conformation, composition, and molecular weight. The hole transport properties of a carbazolyl-substituted siloxane can not be reasonably inferred from the hole transport properties of an isolated N-substituted carbazole compound. Therefore, it would not have been obvious to one of ordinary skill to substitute the tertiary arylamine group taught by Kitano with an N-substituted carbazole group derived from the carbazole compounds taught by Tang et al.

Mimura et al. teach organic polysilanes containing carbazolyl side groups linked to silicon through a propylene linkage ($-\text{CH}_2\text{CH}_2\text{CH}_2-$) have higher hole drift mobilities than polysilanes with alkyl or aryl groups. Notably, Mimura et al. are concerned only with organic polysilanes having a linear $-\text{Si}-\text{Si}-$ silicon backbone. The authors do not teach or suggest that replacing an arylene linkage in a (hypothetical) carbazolyl-substituted *polysiloxane* having an $-\text{Si}-\text{O}-\text{Si}-$

backbone would result in a siloxane polymer *having high hole mobility*. The hole mobilities of the polysilanes of Mimura et al. are not determined merely by the carbazolyl side groups, but rather by the interaction of the carbazolyl side groups with the all silicon backbone of the polymers. Indeed, Mimura et al. teach that the photogenerated charge carriers on the carbazolyl side groups transfer to the Si backbones and then proceed through the Si backbones (page 2200, col. 2, lines 32-34). Given that polysilanes are electrically conductive while polysiloxanes are electrically nonconductive, the hole mobility of a carbazolylpropyl-substituted polysiloxane can not be reasonably inferred from the hole mobility of a carbazolylpropyl-substituted polysilane. Therefore, one of ordinary skill in the art would not be motivated by the teachings of Mimura et al. to replace the divalent aromatic linking group in the siloxane taught by Kitano et al. and improperly modified by Tang et al. (see above), with the propylene group taught by Mimura et al. with the expectation of obtaining a polymer having high hole mobility.

In view of the foregoing remarks, it would not be obvious to one of ordinary skill in the art at the time of the invention to (i) substitute the tertiary arylamine group taught by Kitano with an N-substituted carbazole group derived from the carbazole compounds taught by Tang et al, (ii) replace the divalent aromatic linking group in the siloxane taught by Kitano et al. and improperly modified by Tang et al., with the propylene group taught by Mimura et al., and (iii) then add the siloxane unit resulting from modifications (i) and (ii) to the MQ organopolysiloxane resin taught by Morita.

Claims 6 to 8 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Kitano et al. (U.S. Patent No. 6,544,670) in view of Morita (U.S. Patent No. 5,310,843), Tang et al. (U.S. Patent No. 4,769,292), and Mimura et al. (Photoelectric Properties of Organic Polysilane Containing Carbazolyl Side Groups, Applied Physics Letters, 2 October 2000, 77, No. 14, 2198-2200) for the reasons of record.

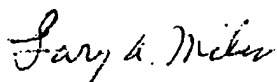
For the reasons stated above with regard to claims 1-5, the teachings of Tang et al. and Mimura et al. can not be properly combined with the teaching of Kitano et al. Therefore, it would not it would not be obvious to one of ordinary skill in the art at the time of the invention to (i) substitute the tertiary arylamine group taught by Kitano with an N-substituted carbazole group

derived from the carbazole compounds taught by Tang et al., (ii) replace the divalent aromatic linking group in the siloxane taught by Kitano et al. and improperly modified by Tang et al., with the propylene group taught by Mimura et al., (iii) add the siloxane units (b) and (c) taught by Morita to the polymer resulting from modifications (i) and (ii); and then replace the hole transporting material in the electroluminescent device of Kitano et al. with the siloxane resulting from modifications (i), (ii) and (iii).

In summary, Applicant submits that claims 1-8 in the instant application are both novel and nonobvious in view of the cited art. Absent sufficient factual inquiry of obviousness, the Office has apparently used the Applicant's teaching to search the art for various fragments of Applicant's macromolecule, namely carbazolyl moieties, divalent linking groups, and siloxane units, and then attempted to reassemble the fragments into a macromolecule having the hole transport properties taught by the Applicant.

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Respectfully Submitted,



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